Abstract

Asian emerging markets have experienced both market liberalization and financial crisis. During the periods covering these two events, I show that the existing asset pricing models are unable to fully capture the risk in the small size, large size, glamour and value portfolios. I hypothesize that these two events changed the degree of market integration, thus varying the risk exposures in portfolios through time. To test the hypothesis, this paper provides a conditional regime-switching model which is able to account for the risk exposures change with respect to different levels of market integration. The two regimes assume that portfolios should be priced globally under completely integrated markets but are priced locally under completely segmented markets. In addition, I incorporate a time-varying integration measure into the model because it allows us to describe the returns variation in partially segmented markets. I find that during pre-liberalization and post-crisis periods, the portfolios’ risk exposures can be attributed more to local risk factors than global ones, while during the periods between
market liberalization and financial crisis, global factors weigh more heavily than local ones. My results suggest Asian emerging markets became more integrated with global capital markets after market liberalization but then turned relatively segmented after the financial crisis.

1 Introduction

During the past decades, the Asian emerging markets have experienced both institutional changes associated with market liberalization and the external shock of financial crisis. These events make stock returns more volatile. In addition, the correlations between countries’ stock returns vary through time. It would be problematic to apply the traditional asset pricing models in the Asian emerging markets because they use returns volatility and correlation to price assets and assume these return characteristics are constant through time. The goal of this paper is to examine how stocks in the Asian emerging markets should be priced with the occurrence of both market liberalization and financial crisis.

In this paper, instead of focusing on aggregate country level returns, I analyze firm level returns by investigating the returns variation of the small size, large size, glamour and value portfolios in the Asian emerging markets. While relatively little work has focused on the behavior of either individual or groups of companies, it would be interesting to examine the reaction of particular types of companies to market liberalization and financial crisis. I will also investigate if the returns of the small, large, glamour and value portfolios exhibited different responses to these events from the responses of aggregate country market returns. It is hoped that this analysis will have implications for portfolio diversification.
To conduct this analysis, I start by considering the existing asset pricing model. The most widely used one is the capital asset pricing model (CAPM). There has been a growing concern among many researchers and practitioners over the ability of single factor CAPM to explain stock returns variation. Tests indicate that many patterns of stock returns variation cannot be explained by the only factor in CAPM, market risk, and are thus labeled anomalies. For example, a growing number of studies show that fundamental variables such as size, book-to-market value, and price to earnings ratios account for a substantial portion of the stock returns variation (see Basu (1977), Stattman (1980), Banz (1981), Rosenberg, Reid and Lanstein (1985), Jaffe, Keim and Westerfield (1989), Chan, Hamao and Lakonishok (1991) and Fama and French (1992)). Based on the above facts, Fama and French (1995) modify CAPM by incorporating into their model two additional factors: the SMB (the difference between the return on a portfolio of small size stocks and the return on a portfolio of large size stocks), which is a good proxy for liquidity risk, and the HML (the difference between the return on a portfolio of high book-to-market value stocks and the return on a portfolio of low book-to-market value stocks), which can capture distress risk. This new model is called the three factor model.

From Fama and French (1995), we know that the three factor model can be appropriately applied in developed countries and captures unexplained stock returns variation. However, this paper is concerned with whether the three factor model can explain the anomalies in emerging markets as well as it did in developed markets. Emerging markets are quite different from developed markets because of several unique characteristics. First, most emerging markets have experienced market liberalization during the past decades. Compared to developed
countries, which have long had unrestricted markets, emerging markets had a lot of investment restrictions before market liberalization while becoming relatively freely accessible to foreigners afterwards. The relaxation of foreign investment barriers led the Asian emerging markets to be more integrated with global capital markets. Based on asset pricing theory, we know that assets should be priced by global risk factors under completely integrated markets but are priced by local ones under completely segmented markets. Thus, if market liberalization shifts market states from segmentation to integration, the risk exposures of the assets in the Asian emerging markets would vary with the liberalization process. In other words, the risk factors that explain stock returns variation in emerging countries should be different from those in developed ones. Moreover, the risk factors that explain stock returns variation in pre-liberalization periods should be different from those in post-liberalization periods.

Another feature in emerging markets is financial crises. As everyone knows, two dramatic financial crises occurred in emerging markets: The Latin American financial crisis in late 1994, and the Asian crisis of late 1997. The financial crises not only caused structural breaks in stock returns variation, as did market liberalization, but also provided striking evidence that the stock returns in emerging markets are more volatile than those in developed markets. From this evidence, we know that the emerging markets are more likely to experience shocks induced by regulatory changes, exchange rate devaluations, and political crises. As we know, traditional asset pricing models use returns volatility and correlation to price assets and assume these characteristics are constant through time. It would be problematic to apply these models in the emerging markets because stock returns characteristics including
returns volatility and correlations are varying during the periods of market liberalization and financial crisis.

In this paper, I concentrate on Asian emerging markets for the following reasons. Most emerging countries across the world belong to two major markets, Latin America and Asia. Many researchers have treated these two groups as the same, and tried to find one framework to generalize the emerging markets in both these areas. But the fact is that although both markets have generally high and volatile returns compared with those of developed countries, they behave quite differently in many ways, including such phenomena as contagion during crisis and company financing strategy. The first evidence for differences between the two markets came from Erb, Harvey and Viskanta (1998). They discovered that the crises in Asia and in Latin America had quite different impacts on their own markets. They found that the Asian crisis had more widespread impacts on currency valuation than did the Latin American crisis. In fact, many more Asian emerging countries’ currencies severely declined in value during the crises while the same phenomenon did not appear in the Latin American crisis. In the Latin American crisis, currency devaluation was restricted to Mexico. From the above evidence, we can conclude that the Asian crisis was a “regional” crisis while the Latin American crisis was mainly caused by Mexico. Therefore, in Asian emerging markets, instead of just accounting for world influence, it is also essential to incorporate regional impacts into the asset pricing model. Another difference is that Latin American countries generally used debt financing more than equity financing, while Asian markets used equity financing more frequently. The evidence mentioned above shows it is necessary to study the Asian emerging market separately because of its uniqueness from its Latin American counterpart.
The goal of this paper is to examine if the events associated with market liberalization and financial crisis changed the risk exposures in portfolios through time, causing the failure of existing asset pricing models in the Asian emerging markets. I hypothesize that these two events changed the market integration for each Asian emerging market, thus varying the risk exposures. The following outlines my reason for including the time-varying risk exposures and market integration in the asset pricing framework. According to Bekaert and Harvey (1995), asset pricing studies can be classified into three categories: segmented markets, integrated markets, or partially segmented markets. If a market is fully integrated with the world market, then the world as well as the Pacific Asian regional market risk factors serve to sufficiently explain the stock returns variation. However, if a market is fully segmented from the international market, only local market risk factors can capture stock returns variation. Therefore, the returns variation of the small size, large size, value and glamour portfolios should follow Fama and French’s three factor model as it does in the U.S. market. This is because the U.S. market, almost equivalent to the world market, can be considered a segmented market. The markets between the above extremes are categorized as partially segmented markets. When we take into account the circumstance of Asian emerging markets, things become more complicated because most of them are partially segmented during our sample periods. Most Asian emerging markets internationally liberalized during the beginning of the 1990s so that their economies became more financially integrated with international capital markets. However, after the 1997 Asian financial crisis, markets became more segmented from the world market because of foreign companies’ hesitation about investing in Asian emerging markets and the investment restrictions set by some governments in Asian
emerging countries. Another feature is the spillover or contagion effects across the Asian
emerging markets during crisis periods. This phenomenon seems to lead to an increase in
the regional effect. If the spillover or contagion effects across the Pacific Asian region dom-
ine the segmentation impacts caused by investors’ hesitation or investment restrictions,
then Asian emerging markets would become more integrated with international markets.
Otherwise, they would be more segmented. To analyze this case closely, we need to measure
the time-varying integration level for each Asian emerging market.

As I show in this paper, the three factor model cannot adequately explain the anomalies
in the Asian emerging markets. I also find that the results estimated by the three factor
model are significantly different among the pre-liberalization period, post-liberalization pe-
riod and post-crisis period. I discover that the three factor model can adequately explain the
anomalies in possibly segmented periods such as pre-liberalization and post-crisis periods,
but cannot fully capture the factors causing anomalies in possibly integrated periods like the
post-liberalization period. This finding confirms my assumption that in order to explain the
anomalies in the post-liberalization period, we need to take international market risk into
account rather than just considering local market variables in our model. The estimated
results also suggest that it is important to consider the time varying integration process.

Therefore, I incorporate this important feature to modify the three factor model to see if
we can get more robust estimators than the existing models. For reasons of comparison, I
include the results estimated by CAPM and by the three factor model.

To account for the risk exposures change with respect to different levels of market inte-
gression, I propose a conditional Markov regime switching model. There are two regimes in
my model. Portfolios under the first regime, completely integrated market states, will be priced by the international CAPM consisting of the world as well as the Pacific Asian regional risk factors. Portfolios under the second regime, completely segmented market states, will follow the three factor model. Since most of the Asian emerging countries belong to partially segmented markets, I use the time-varying integration measure to represent the likelihood that the market is fully integrated with the global market. If we observe that countries show different patterns of time-varying integration measures, then we can conclude that stock returns should differ across different countries through time.

The Markov regime switching model provides us with more accurate assumption for the stock return distribution in the Asian emerging markets. It is now well known that stock returns exhibit non-normal distribution features, such as fat-tailed distributions and an asymmetric tendency for returns to be more highly correlated in bear markets than in bull markets (see Longin and Solnik (2001) and Bulter and Joaquin (2002)). These two features are especially relevant for the Asian emerging market because these kinds of characteristics will be amplified during the transformation of market states. As Bekaert, Erb, Harvey and Viskanta (1998) discussed in their paper, the skewness and kurtosis of emerging market returns change through time given the transformation that occurs in emerging markets moving from a state of segmentation to a state of integration. They also observe that intra-regional correlations increase during the crisis period. Because of its ability to capture non-normality and asymmetric correlations, I represent stock returns in the Asian emerging markets through a Markov regime switching model.

My results show that all sample countries have their own time-varying market integra-
tion degree. I conclude that stocks should be priced differently across different countries during the sample periods. But the market integration degrees for all countries tended to increase gradually after market liberalization, while after the 1997 financial crisis, those of the crisis-prone countries, including Korea, Malaysia, Philippines and Thailand, dramatically decreased. This implies that the Asian emerging markets became more integrated with foreign capital markets after market liberalization but then turned relatively segmented after the financial crisis. Moreover, the segmentation induced by the financial crisis had stronger and more enduring impacts on the Asian emerging markets’ returns than did the spillover effects across the region. As market integration differs through time with the occurrence of market liberalization and financial crisis, so do the risk exposures in portfolios. I find that during pre-liberalization and post-crisis periods, the portfolios’ risk exposures can be attributed more to local risk factors than global ones, while during the periods between market liberalization and financial crisis, the global factors weigh more heavily than local ones. In addition, for the portfolio returns, I discover that the country risk factors can explain a much greater portion of return variation than can either the SMB or the HML factor. Unfortunately, due to the model specification, my model might underestimate the downside risk in the Asian emerging markets return. However, it is still on the right track to incorporate the world as well as the Pacific Asian regional market risk factors to explain the portfolio return variations in the partially segmented countries. As past research shows that the correlations between the Asian emerging markets and other countries are higher during recessions, international investors will be hurt because of the deviation of the expectation of global diversification. However, my robustness check results imply that during
crisis periods, investing country index funds in India, Korea and Malaysia can still get diversification benefits due to the low dependence between the downside risk and international information variables. In Pakistan and the Philippines, although investors cannot get global diversification benefits from investing country index funds directly, they can alternatively invest in large size or value portfolios in these two countries to diversify the risk of the global portfolios.

My paper is organized as follows. In Section 2, I introduce the data and summary statistics. Section 3 contains the econometric methodology. Empirical results are presented in Section 4. In Section 5, I will do a model robustness check. Some concluding remarks are offered in Section 6.

2 Data and Summary Statistics

In this section, I examine the size and value premium in seven Asian emerging markets: India, Korea, Malaysia, Pakistan, the Philippines, Taiwan and Thailand. I use monthly stock returns from the Emerging Market Data Base (EMDB). Because of the different data availabilities in these countries, the data period is from Jan. 1986 to Feb. 2003 for Malaysia and Taiwan, from Jun. 1986 to Feb. 2003 for India, Korea, Pakistan and Thailand, and from Jun. 1988 to Feb. 2003 for the Philippines. I sort stocks by their market capitalization, selecting bottom 30% small market capitalization stocks to form small size portfolio, and top 30% large market capitalization stocks to form large size portfolio. Likewise, I sort stocks by their book-to-market value (B/M), selecting bottom 30% low B/M stocks to form glamour portfolio, and top 30% high B/M stocks to form value portfolio. To capture the effects of
size and book-to-market value, I use the SMB and HML hedge portfolios formed by Fama and French for each sample country. I assume that investors adopt the investing strategy to buy and hold portfolios for six months, so their portfolios are not rebalanced until every six months. Next, CAPM and the three factor model will be estimated in these portfolios so that we can see whether these models can adequately explain the stock anomalies.

Table I presents the CAPM results. CAPM can successfully explain the stock anomalies if the estimated results can fulfill two requirements. The first is that the intercept should be statistically insignificant from zero, and the second is that the sensitivity to the excess market return (beta) is statistically significant from zero. The above requirements imply that the market risk factor of CAPM can completely capture the cross-sectional variation of expected excess return. From Table I, the second requirement is easily achieved because all of betas are statistically significant. However, when we check the first requirement, we find that out of seven sample countries, only two show statistically insignificant intercepts in the small and the large size portfolios, three in the glamour portfolio and six in the value portfolio. The Table I results suggest that CAPM is unable to fully capture the variation of stock returns.

Next, I apply the three factor model to check if it can completely explain the anomalies in Asian emerging markets. Like CAPM, the three factor model also has two requirements for the model to adequately explain the anomalies: the intercept is statistically insignificant, and the betas for excess market return, SMB and HML, are statistically significant. I present the three factor model estimated results in Table II. From Table II, we find that more than 90% of the countries demonstrate the statistically significant betas for the excess market
return, the SMB and the HML. However, for the intercept condition, only two out of seven
countries fulfill the requirement in the small, large and glamour portfolios, and four countries
in the value portfolio. From my observations, we can conclude that neither CAPM nor the
three factor model can successfully explain the anomalies in Asian emerging markets. In
addition to the factors input in CAPM and the three factor model, there must exist other
factors that need to be taken into account in Asian emerging markets.

One possible direction in solving this puzzle is to consider the structural breaks occurring
in Asian emerging markets such as market liberalization and the 1997 Asian financial crisis.
To proceed, we need to define possible break dates for eight countries. I adopt Bekaert and
Harvey’s discussion of the choices for official liberalization dates (2000) to define the market
liberalization break date in my research. The possible break dates for each Asian emerging
country are summarized in Table III. Because India and Pakistan were not involved in the
1997 Asian financial crisis, they have only one break date, which is associated with market
liberalization. The remaining countries all have two break dates, the market liberalization
break dates and the 1997 Asian financial crisis break dates.

I use those possible break dates to separate sample periods into partitions for each coun-
try. For example, India has two partitions because it only has one break date, while Korea
has three partitions because it has two breaks. As a result, I can define the pre-liberalization
period as partition 1, the period between market liberalization and crisis break dates as par-
tition 2 and the post-crisis period as partition 3. Next, I test the three factor model in each
partition for each country. The results are presented in Table IV. From the table, I observe
that for each specific portfolio, some countries have statistically significant/insignificant in-
tercept terms or betas in one partition, followed by statistically insignificant/significant ones in the next partition. For instance, in the small size portfolio, five countries have statistically significant intercept terms in partition 2, but have insignificant intercepts both in partition 1 and partition 3. The above pattern is presented in four countries in the large size portfolio, three in the glamour portfolio, and one in the value portfolio. These findings are interesting because they imply that the three factor model can be adequately applied in pre-liberalization and post-crisis periods, which are also referred to as the market segmentation periods, but fails in partition 2, the market integration period. My discovery suggests that time variation and integration level are important and these two factors need to be incorporated to match the conditions of the Asian emerging markets.

3 Methodology

The results of the partition test presented in Section 2 suggest that we should incorporate time varying integration process into the model. To adopt the time variation feature, I use a conditional setting model. To characterize the risk exposures change with respect to different levels of market integration, I assume that under different market states, the expected excess returns on assets follow different models. When markets are completely integrated, assets should have the same price regardless of where they are traded. In other words, only the world and the Pacific regional market factors, but not any local factor, can determine the returns on all assets. However, when markets are segmented, the price of an asset depends on where it is traded. Therefore, only local factors will determine the price of an asset. When markets are completely integrated, the excess returns on assets should follow the conditional
international CAPM, which can be represented as:

\[
E_{t-1}(r^A_{i,t}) = \phi_{\text{reg},t-1}\lambda_{t-1} Cov_{t-1}[r^A_{i,t}, r_{w.t}] + (1 - \phi_{\text{reg},t-1}) \lambda_{\text{reg},t-1}\{Cov_{t-1}[r^A_{i,t}, r_{\text{reg},t}] - p_1 Cov_{t-1}[r^A_{i,t}, r_{w.t}]\} = \phi_{\text{reg},t-1}\lambda_{t-1} Cov_{t-1}[r^A_{i,t}, r_{w.t}] + (1 - \phi_{\text{reg},t-1}) \lambda_{\text{reg},t-1}\{Cov_{t-1}[r^A_{i,t}, r_{\text{reg},t}] - p_1 Cov_{t-1}[r^A_{i,t}, r_{w.t}]\} \tag{1}
\]

where \(E_{t-1}(r^A_{i,t})\) is the conditionally expected excess return on portfolio A in country \(i\). For instance, \(r^S_{i,t}\) represents the excess return on the small portfolio in country \(i\). \(r^L_{i,t}\) is the excess return on the large portfolio. \(r^V_{i,t}\) represents the excess return on the value portfolio, and \(r^G_{i,t}\) is the excess return on the glamour portfolio. \(r_{w.t}\) is the return on a value weighted world market portfolio and \(\lambda_{t-1}\) is the conditionally expected world market price of risk for time \(t\). Similarly, \(r_{\text{reg},t}\) is the return on a value weighted Pacific Asian regional market portfolio and \(\lambda_{\text{reg},t-1}\) is the conditionally expected regional market price of risk for time \(t\). \(p_1\) is the percentage of covariance between portfolio A and the world market return, but overlaps the covariance between portfolio A and the regional market return. We can also interpret this overlap as the indirect world market impact on the portfolio return through the regional market. To eliminate this double count, we have to deduct this overlap from the regional risk exposure part. I assume that:

\[
p_1 = 1 - \frac{\text{Corr}[r^A_{i,t}, r_{w.t}]}{\text{Corr}[r^A_{i,t}, r_{\text{reg},t}, r_{w.t}]} \tag{2}
\]

This assumption is intuitive. If \(p_1\) is close to zero, the correlation between the portfolio’s return and the world market’s return is high. Therefore, the world market impacts on the

\(^1\)All portfolios’ returns used in this paper are dollar based. Since all stocks used by the EMDB are tradable for foreign investors, we can ignore the situation that in fully restricted markets, investors only cares about local currency returns.
portfolio’s return rarely channel indirectly through the regional market. On the other hand, if $p_1$ is close to one, the correlation between the portfolio’s return and the world market’s return is low. As a result, the world market impacts on the portfolio’s return have to channel through the regional market. For the regional market return case, $p_1 = 0$. And the model can be reduced to:

$$E_{t-1}(r_{reg.t}) = \phi_{reg,t-1}\lambda_{t-1}Cov_{t-1}[r_{reg.t},r_{w,t}] + (1 - \phi_{reg,t-1}) \lambda_{reg,t-1}Var_{t-1}[r_{reg.t}]$$ (3)

The Pacific Asian region also experienced market integration during these periods. Here, I assume the variation of the regional market return should be fully explained by the world market CAPM if the Pacific Asian regional market is fully integrated with the world market. And this world CAPM can be represented as:

$$E_{t-1}(r_{reg.t}) = \lambda_{t-1}Cov_{t-1}[r_{reg.t},r_{w.t}]$$ (4)

However, if the regional market is completely segmented from the world market, the regional market return follows the regional CAPM. In this model, all of the variation of the regional market return will be determined by its own variance risk.

$$E_{t-1}(r_{reg.t}) = \lambda_{reg,t-1}Var_{t-1}[r_{reg.t}]$$ (5)

To adopt the time varying integration feature in the model, I input a time varying probability $\phi_{reg,t-1}$, which falls in the interval $[0, 1]$. $\phi_{reg,t-1}$ represents the integration level of the regional market. Furthermore, equation (3) can be viewed as the weighted average of the world CAPM and the regional CAPM.
To infer $\phi_{\text{reg},t-1}$ from the data, I adopt the regime switching model with time varying transition probabilities. To ensure the probabilities between zero and one, I assume that the transition probabilities, $P_{\text{reg}}^t$ and $Q_{\text{reg}}^t$, are logistic functions of a subset of regional information variables, $Z_{\text{reg},t-1}^t$, which includes a constant and the dividend yield in the Pacific Asian region.

$$P_{\text{reg}}^t = \text{prob}[S_t = 1|S_{t-1} = 1] = \frac{\exp\left(\beta_1^{\text{reg}} Z_{\text{reg},t-1}^t\right)}{1 + \exp\left(\beta_1^{\text{reg}} Z_{\text{reg},t-1}^t\right)}$$ (6)

$$Q_{\text{reg}}^t = \text{prob}[S_t = 2|S_{t-1} = 2] = \frac{\exp\left(\beta_2^{\text{reg}} Z_{\text{reg},t-1}^t\right)}{1 + \exp\left(\beta_2^{\text{reg}} Z_{\text{reg},t-1}^t\right)}$$

Next, we have to relate the transition probabilities with the market integration degree, $\phi_{t-1}$. From Gray (1995), we can get the following recursive representation for the market integration degree as the function of the transition probabilities:

$$\phi_{\text{reg},t-1} = (1 - Q_{t-1}^{\text{reg}}) + (P_{t-1}^{\text{reg}} + Q_{t-1}^{\text{reg}} - 1) \left[ \frac{f_{1t-1}\phi_{\text{reg},t-2}}{f_{1t-1}\phi_{\text{reg},t-2} + f_{2t-1}(1 - \phi_{\text{reg},t-2})} \right]$$ (7)

where $f_{j,t}$ is the likelihood at time $t$ conditional on being in regime $j$ and time $t-1$ information set, $S_{t-1}$.

From equation (1), we know in the completely integrated market, the asset will be priced by the international CAPM. While in the completely segmented market, I suppose that the excess returns on the characteristics portfolios (the small, large size, glamour and value portfolios) should follow Fama and French’s three factor model:
\[ E_{t-1}(r^A_{i,t}) = \lambda_{i,t-1} Cov_{t-1} [r^A_{i,t}, r_{i,t}] + \lambda^s_{i,t-1} Cov_{t-1} [r^A_{i,t}, r_{smht}] + \lambda^v_{i,t-1} Cov_{t-1} [r^A_{i,t}, r_{hml,t}] \]  

(8)

where \( \lambda_{i,t-1} \) is the conditionally expected country price of risk. \( \lambda^s_{i,t-1} \) is the conditionally expected price of size risk; and \( \lambda^v_{i,t-1} \) is the conditionally expected price of value risk.

However, since my sample countries might display market state transformation from segmentation to integration before the market liberalization and probably switch from integration to segmentation after the 1997 financial crisis, neither equation (1) nor (8) can illustrate the portfolio return movement in the Asian emerging markets. The asset pricing model in the Asian emerging markets should be between (1) and (8). We call these kinds of markets partially segmented markets. To characterize the return movement in the partially segmented market, I adopt the Markov regime switching model with two regimes: a completely integrated market regime and a completely segmented market regime. In the first regime, the completely integrated markets, the portfolio return is drawn from a distribution given by equation (1). In the second regime, the portfolio return is given by equation (8).

Just as \( \phi_{reg,t-1} \) does in the regional market return case, I also define a time varying probability, \( \phi_{i,t-1} \), which can control the integration level for each sample country. Therefore, the returns on the specific portfolios can be represented as:
\[ E_{t-1}(r^A_{it}) = \phi_{i,t-1} \left( \phi_{reg,t-1}\lambda_{t-1} Cov_{t-1}[r^A_{it},r_{wt}] + (1 - \phi_{reg,t-1}) \lambda_{reg,t-1} \{ Cov_{t-1}[r^A_{it},r_{reg}^t] - p_1 Cov_{t-1}[r^A_{it},r_{wt}] \} \right) \]

\[ + (1 - \phi_{i,t-1}) \left( \lambda_{i,t-1} Cov_{t-1}[r^A_{it},r_{i,t}] + \lambda_{s,t-1} Cov_{t-1}[r^A_{it},r_{smbt}] + \lambda_{v,t-1} Cov_{t-1}[r^A_{it},r_{hmt,t}] \right) \]

(9)

In the same way I did in the regional market return case, I define that the transition probabilities for each sample country, \( P_t \) and \( Q_t \), are logistic functions of a subset of local information variables, \( Z^*_t \):

\[ P_t = \text{prob} \{ S_t = 1 | S_{t-1} = 1 \} = \frac{\exp(\beta_1 Z^*_t)}{1 + \exp(\beta_1 Z^*_t)} \]

(10)

\[ Q_t = \text{prob} \{ S_t = 2 | S_{t-1} = 2 \} = \frac{\exp(\beta_2 Z^*_t)}{1 + \exp(\beta_2 Z^*_t)} \]

where \( Z^*_{t-1} \) includes lagged dividend yields and lagged equity market capitalization as a proportion of GDP. These two variables are supposed to be influenced by policy changes affecting market integration degree, so these variables should influence the transition probabilities as well. Therefore, we can derive the following recursive representation:

\[ \phi_{i,t-1} = (1 - Q_{t-1}) + (P_{t-1} + Q_{t-1} - 1) \left[ \frac{f_{1,t-1}\phi_{1,t-2}}{f_{1,t-1}\phi_{1,t-2} + f_{2,t-1}(1 - \phi_{1,t-2})} \right] \]

(11)

where \( f_{j,t} \) is the likelihood at time \( t \) conditional on being in regime \( j \) and time \( t-1 \) information set, \( \$_{t-1} \).

To capture the time varying feature of the international price of risk, the country price of risk, the price of size and value risk, we assume that the world price of risk will be influenced
by a set of world information variables, \( Z_{t-1} \). Likewise, the regional price of risk will be determined by regional information variables, \( Z_{t-1}^{\text{reg}} \). The country price of risk, the price of size and value risk are affected by a set of local information variables, \( Z_{t-1}^{i} \), which can be represented as:

\[
\begin{align*}
\lambda_{t-1} &= d(\delta^0 Z_{t-1}) \\
\lambda_{\text{reg},t-1} &= d(\delta^0 Z_{t-1}^{\text{reg}}) \\
\lambda_{i,t-1} &= d(\delta^0_i Z_{t-1}^{i}) \\
\lambda_{i,t-1}^{p} &= d(\delta^p_i Z_{t-1}^{i}) \quad p = s,v
\end{align*}
\]

(12)

where \( d \) is a function to ensure that the price of risk is always positive:

\[
d(x) = \begin{cases} 
  x & x > 0 \\
  0 & x \leq 0 
\end{cases}
\]

(13)

\( Z \) includes a constant, the world market dividend yield, the default spread (Moody’s Baa minus Aaa bond yields), the change in the term structure spread (U.S. 10-year bond yield minus 3-month U.S. bill), and the change in the 30-day Eurodollar rate. \( Z_{t-1}^{\text{reg}} \) consists of a constant, the Pacific Asian regional market return and the regional dividend yield. \( Z_{t-1}^{i} \) is the set of local information variables including a constant, local equity returns, local exchange rate changes, local dividend yields, and the ratio of equity market capitalization to GDP.

Next, I am going to use ML (Maximum likelihood) to estimate unknown parameters. Appendix A provides further details on the construction of likelihood function.
4 Empirical Results

Because there are too many parameters needed to be estimated, we can simplify as four stage estimation. The first stage focuses on estimating the world price of risk, $\lambda_{t-1}$. Then I bring the estimated results into the second stage to estimate the regional price of risk, $\lambda_{\text{reg},t-1}$, and the regional market integration level, $\phi_{\text{reg},t-1}$. Next, the results from the first and second stages will be embodied into the third stage to estimate the country price of risk, $\lambda_{i,t-1}$, and the market integration level for each country, $\phi_{i,t-1}$. Finally, I apply all previous results into the last stage to estimate the price of size risk, $\lambda_{i,t-1}^s$, and the price of value risk, $\lambda_{i,t-1}^v$. Appendix B gives further details on the method in each stage to estimate the parameters.

4.1 The first stage

By Maximum Likelihood, we can get the estimators for $\{\delta^0, \alpha, c\}$. I report the estimated results in Table V. I also plot the fitted world price of risk, $\widetilde{\lambda}_{t-1}$, in Figure I. From the National Bureau of Economic Research U.S. business cycle, the troughs during my sample periods occurred in March, 1991 and November, 2001. Figure I shows that the world price of risk is not constant but the movement of the price of risk is almost consistent with the U.S. business cycles. This discovery confirms Fama and French’s (1989) argument that the price of risk should be higher in economic recessions to lure investors into the market.

4.2 The second stage

The key part in this stage is to use ML to get the estimators for $\{\lambda_{\text{reg}}, \phi_{\text{reg}}\}$. The estimated market integration for the Pacific Asian region, $\widehat{\phi}_{\text{reg},t-1}$, is plotted in Figure II. From Figure
II, we can observe that the market integration degree in the Pacific Asian region increases gradually before 1991. However, from 1991 to 1993, the regional integration degree decreases a lot. This might be due to Japan’s recession, reducing imports from other countries. In addition, during the recession time, risk-averse Japanese investors were reluctant to invest abroad and even ready to bring home their overseas assets. Therefore, we expect the market integration level of the Pacific Asian region would decrease as Japan, the largest country in this region, experienced recession during these periods. The same reason can apply to the decrease of the market integration level during the periods from 1997 to 1998 and from 2001 to 2003. The troughs from 1997 to 1999 lasted longer probably because of the Asian financial crisis. After the 1997 Asian financial crisis, the integration degree of the Asian region was deteriorated since foreign companies hesitated to invest in Asian emerging markets and some governments in Asian emerging countries also set investment restrictions.

4.3 The third stage

In this stage, I use ML to get the estimators for \( \hat{\lambda}_i, \hat{\phi}_i, \hat{C}_i, \hat{C}_p, \hat{A}_i, \hat{A}_I \). The estimated market integration for the seven sample countries, \( \hat{\phi}_{i,t-1} \), are plotted in Figure III. From Figure III, we can observe that the market integration degrees for all sample countries increase gradually after market liberalization. And in Korea, Malaysia, the Philippines and Thailand, the market integration degrees drop dramatically during the 1997 Asian financial crisis periods. This finding indicates that the market became more integrated with global capital markets after market liberalization, but turned to be more segmented because of financial crisis. In Desai’s (2003) country classification, Korea, Malaysia, Thailand and the
Philippines are categorized as crisis-prone countries. In other words, these countries were overwhelmed by the seismic shifts in their financial health and currency values that hit their economies in 1997 and 1998. In contrast, Taiwan belongs to the crisis-immune category because it managed to avoid the financial turmoil and limited exposure to short-term capital inflows. Therefore, from Figure III, we cannot observe the same pattern on the movement of the market integration degree in Taiwan as we did in the crisis-prone countries. In Table VI, I summarize the average market integration degree by partitions for each country. We can see that in India, Korea, Malaysia, Pakistan and the Philippines, the average market integration degree is higher in the post-liberalization periods than that either in the pre-liberalization periods or the post-crisis periods. This finding is consistent with Figure III, suggesting that the integration degree increases after market liberalization but decreases after the financial crisis. Figure IV reports the fitted country price of risk for the seven countries. From Figure IV, we see that the crisis-prone countries, Korea, Malaysia, the Philippines and Thailand, exhibit abnormally high country price of risk during the crisis periods, confirming Fama and French’s (1989) argument that risk premiums should be higher during economic recessions.

4.4 The fourth stage

Next, I bring the estimated results from the third stage to estimate the rest of parameters. I follow the methodology that is stated in section 3, and get the estimated results of \( \{\lambda_1^S, \lambda_1^V, C^l, C^S, A^1, A^S\} \). Here, I suppose that the conditional covariance between SMB and the specific portfolio return is approximately equal to the difference of the covariance between the small and specific portfolio return and that between the large and specific portfolio return.
return. The expression is as follows:

\[ \text{Cov}_{t-1} \left[ r_{i,t}^A, r_{SMB,t} \right] \approx \text{Cov}_{t-1} \left[ r_{i,t}^A, r_{i,t}^S \right] - \text{Cov}_{t-1} \left[ r_{i,t}^A, r_{i,t}^b \right] \]

On the other hand, I suppose that the conditional covariance between HML and the specific portfolio return is approximately equal to the difference of the covariance between the value and specific portfolio return and that between the glamour and specific portfolio return. Therefore:

\[ \text{Cov}_{t-1} \left[ r_{i,t}^A, r_{HML,t} \right] \approx \text{Cov}_{t-1} \left[ r_{i,t}^A, r_{i,t}^h \right] - \text{Cov}_{t-1} \left[ r_{i,t}^A, r_{i,t}^l \right] \]

Figure V contains the fitted price of size risk for each country, and Figure VI reports the fitted price of value risk. Although these two kinds of price of risk have similar patterns with the country price of risk, they are much smaller than the country price of risk. This discovery suggests that despite the change of market integration, the country risk always accounts for a greater portion in explaining the variation of the portfolio return than either the SMB or the HML factor does. Another interesting observation is that in India, Pakistan and the Philippines, the price of size risk and of value risk increase before market liberalization but decrease after market liberalization. This can be explained by the fact that emerging markets increase investment premiums to attract investors into markets before market liberalization. However, once the number of market participants becomes larger, prices should decrease to reach the market equilibrium.
5 Robustness Check

To test if the conditional model with time varying integration can completely capture the stock returns variation in the Asian emerging market, I construct an alternative model:

\[
r_{i,t}^A = \xi' s_{t-1} + \phi_{i,t-1} \left( \phi_{\text{reg},t-1} \lambda_{t-1} \text{Cov}_{t-1} [r_{i,t}^A, r_{w,t}] + (1 - \phi_{\text{reg},t-1}) \lambda_{t-1} \{ \text{Cov}_{t-1} [r_{i,t}^A, r_{\text{reg},t}] - \rho_1 \text{Cov}_{t-1} [r_{i,t}^A, r_{w,t}] \} \right)
+ (1 - \phi_{i,t-1}) \left( \lambda_{i,t-1} \text{Cov}_{t-1} [r_{i,t}^A, r_{i,t}] + \lambda_{s,t-1} \text{Cov}_{t-1} [r_{i,t}^A, r_{\text{smi},t}] + \lambda_{v,t-1} \text{Cov}_{t-1} [r_{i,t}^A, r_{\text{hmi},t}] \right) + \varepsilon_{i,t}^A
\]

$s_{t-1}$ is a set of lagged information variables including all international and local information variables that are defined in Section 3. Like the testing procedure for the CAPM and the three factor model, I input into the model a time varying intercept term, $\xi' s_{t-1}$, and would like to examine if the coefficient, $\xi$, is statistically insignificant. If $\xi$ is statistically insignificant, then we can say this model is robust.

To proceed, I regress the residual of both the aggregate market and the portfolio returns for each country from the original model on the information variables. I classify these information variables into three categories: international information variables, \( \{Z, Z^{\text{reg}}\} \); local information variables, \( Z^i \); and total information variables, \( \{Z, Z^{\text{reg}}, Z^i\} \). The adjusted R-squared and the Wald statistics are reported in Table VII. Based on the assumption in my paper, the price of risk is always positive. In addition, most of the covariances between the portfolio return and either the international or the country market return are positive. Therefore, the model has a disadvantage in estimating the downside risk. When
the sample periods in my paper cover the financial crisis, this drawback is magnified. From the Wald statistics in Table VII, I observe that for the aggregate market returns residual, almost all local information variable coefficients are statistically significant from zero, while in India, Korea and Malaysia, the international information variable coefficients pass the robustness check. From past studies, we know during crisis periods, the correlation between countries and the global market tend to increase, causing profit loss in global diversification. However, my results imply that investing country index funds in India, Korea and Malaysia can still get diversification benefits due to the low dependence between the downside risk and international informational variables. By the same logic, in Pakistan and the Philippines, although investors cannot get global diversification benefits from investing country index funds directly, they can alternatively invest large size or value portfolios in these two countries to diversify the risk of the global portfolios.

6 Conclusion

Although Fama and French’s three factor model has proven to perform well in developed countries, it fails to fully capture the portfolio returns variation during the periods covering the market liberalization and financial crisis. In this paper, I hypothesize that these two events changed the level of market integration, thus varying the risk exposures in pricing models. To account for the risk exposures change with respect to different degrees of market integration, I construct a time-varying integration model. This model allows the portfolio returns in the Asian emerging markets to follow a mixture of the international CAPM (completely integrated model) and the three factor model (completely segmented model).
The estimated results show that market liberalization increased market integration for all sample countries; and the financial crisis dramatically decreased the market integration for the crisis-prone countries, including Korea, Malaysia, the Philippines and Thailand. My finding indicates that the Asian emerging markets became more integrated with global capital markets after market liberalization but then turned relatively segmented after the financial crisis. In addition, the above results imply that the segmentation induced by the financial crisis had stronger and more enduring impacts on the Asian emerging markets’ return than did the spillover effects across the Asian region.

As market integration varies with the occurrences of market liberalization and financial crisis, so do the risk exposures in portfolios. I find that during pre-liberalization and post-crisis periods, the portfolios’ risk exposures can be attributed more to local risk factors than global ones, while during the periods between market liberalization and financial crisis, the global factors are stronger than local ones. My results also show that the country risk factor can explain a greater portion of the portfolio returns variation than can either the SMB or the HML factor. Unfortunately, due to the model specification, my model might underestimate the downside risk embodied in the Asian emerging markets’ return. However, it is still valuable to incorporate the global market risk factors to explain the portfolio returns variation in the partially segmented countries.

From past studies, we know during crisis periods, the correlations between countries and the global market tend to increase so that foreign investors would lose profits of diversification. However, my robustness check results imply that in some countries, foreigners can alternatively invest in large size or value portfolios to diversify the risks of the global portfo-
This is due to the low dependence between the portfolios’ downside risk and the global market.

There are several possible extensions of my paper. First, since the model proposed in this paper cannot successfully capture the downside risk of the portfolio returns, it would be ideal if some framework could be built to fully absorb the downside risk in the bear market state. Next, while the crisis-prone and crisis-immune countries are classified in East Asia, I am concerned with the contagion within the crisis-prone countries but not within the whole Asian region. However, my model only considered the regional effect, not the interaction among those crisis-prone countries. It would be interesting if further research extends in this direction.

References


Appendix A. Likelihood Function

From equation (9), we know that the portfolio returns will follow the mixture of international CAPM and Fama and French’s three factor model. However, if we replace the portfolio return with the world market return, we get:

\[
    r_{w,t} = \lambda_{t-1} Var_{t-1} [r_{w,t}] + \epsilon_{w,t}
\]

(14)

Here, since we know the world market should be completely integrated with itself, the regime probability, \( \phi_{i,t-1} \), as well as \( \phi_{reg,t-1} \), are equal to one. Then I substitute the portfolio return for the regional market return, and the model becomes equation (3). Similarly, the country market return case can be presented as:

\[
    r_i,t = \phi_{i,t-1} \left( \phi_{reg,t-1} \lambda_{t-1} Cov_{t-1} [r_{i,t}, r_{w,t}] 
        + (1 - \phi_{reg,t-1}) \lambda_{t-1} Cov_{t-1} [r_{i,t}, r_{reg,t}] 
        + \epsilon_{i,t} \right)
\]

(15)

And we also know the specific portfolio returns follow equation (9).

Therefore, we can combine equation (14), (3), (15) and (9) to build the model. Let

\[
    R_{i,t} = [r_{i,t}, r_{i,t}^b, r_{i,t}^h, r_{i,t}, r_{i,t}, r_{reg,t}, r_{w,t}]'
\]

\[
    e_{i,t} = [\epsilon_{i,t}, \epsilon_{i,t}^b, \epsilon_{i,t}^h, \epsilon_{i,t}, \epsilon_{i,t}, \epsilon_{reg,t}, \epsilon_{w,t}]'
\]

30
and define \( e^I_t \) (\( e^S_t \)) as the residual vector under market integration (segmentation). Therefore,

\[
et = \phi_{i,t-1}e^I_t + (1 - \phi_{i,t-1}) e^S_t
\]  

(16)

we assume that the conditional variance under market integration, \( \sum^I_t \), is different from that under market segmentation, \( \sum^S_t \). To characterize the variance clustering, I model these two conditional variance as ARCH(3):

\[
\begin{align*}
\sum^I_t &= C^I + (A^I)^0 \left[ \sum_{k=1}^3 \omega_k (e_{t-k} e^0_{t-k}) \right] A^I \\
\sum^S_t &= C^S + (A^S)^0 \left[ \sum_{k=1}^3 \omega_k (e_{t-k} e^0_{t-k}) \right] A^S
\end{align*}
\]  

(17)

where \( C^I, C^S, A^I \) and \( A^S \) are symmetric 7×7 matrices. For \( \omega_k \) computation, I adopt the method of Engle, Lilien and Robbins (1987) to let \( \omega_k = 2(3+1-k)/(3(3+1)) \). Therefore, the resulting weight on the three past residual vectors are 1/2, 1/3 and 1/6. The model setting is advantageous because unlike the normal ARCH or GARCH model, it successfully economizes on parameters estimation.

In addition, I impose the following constraints on some elements of \( C^I, C^S, A^I \) and \( A^S \):
\[ C^I (7, 7) = C^S (7, 7), \]
\[ C^I (6, 6) = C^S (6, 6), \]
\[ C^I (5, 6) = C^I (6, 5) = C^S (5, 6) = C^S (6, 5), \]

\[ A^I (j, j) = A^S (j, j) \quad \text{for} \quad j = 1, 2, \ldots, 7 \]
\[ A^I (j, 7) = A^S (j, 7) = 0 \quad \text{for} \quad j = 1, 2, \ldots, 6 \]
\[ A^I (j, 6) = A^S (j, 6) = 0 \quad \text{for} \quad j = 1, 2, \ldots, 5 \]
\[ A^I (j, 5) = A^S (j, 5) = 0 \quad \text{for} \quad j = 1, 2, \ldots, 4 \]
\[ A^S (7, j) = 0 \quad \text{for} \quad j = 1, 2, \ldots, 6 \]
\[ A^S (6, j) = 0 \quad \text{for} \quad j = 1, 2, \ldots, 5 \] \hspace{1cm} (18)

The first four restrictions make the conditional variance of the world market return and that of the regional market return independent of the regime. The restriction \( A^I (j, 7) = A^S (j, 7) = A^I (j, 6) = A^S (j, 6) = 0 \) ensures that neither country-specific shocks nor portfolio-specific shocks affect the conditional variance of the international market return. And the restriction \( A^I (j, 5) = A^S (j, 5) = 0 \) ensures that portfolio-specific shocks do not affect the conditional variance of the country returns. The last restriction, \( A^S (7, j) = A^S (6, j) = 0 \), states that the international shocks do not affect the conditional variance of the country return and specific portfolio returns when the market is segmented.

Given the above setting, we can have the likelihood function for \( R_{i,t} \):

\[ \log L (R_{i,T}) = \sum_{t=1}^{T} \log \left\{ \phi_{i,t-1} g_{1,t} + (1 - \phi_{i,t-1}) g_{2,t} \right\} \] \hspace{1cm} (19)
Then we can use ML (maximum likelihood) to get the estimators for 
\{ \lambda, \lambda_{reg}, \lambda_{i}, \lambda_{i}^{S}, \lambda_{i}^{v}, \phi_{reg}, \phi_{i}, C^{l}, C^{S}, A^{l}, A^{S} \}

Appendix B. Stage Estimation

The first stage

I separate the world market return part from the model so that the ARCH-M model can be represented as follows:

\[ r_{w,t} = \lambda_{t-1} Var_{t-1} [r_{w,t}] + \varepsilon_{w,t} \]

where \( \lambda_{t-1} \) and \( Var_{t-1} [r_{w,t}] \) are given by:

\[
\lambda_{t-1} = d(\delta^{0} Z_{t-1}) \]

\[
d(x) = \begin{cases} 
  x & \text{if } x > 0 \\
  0 & \text{if } x \leq 0 
\end{cases}
\]

\[
Var_{t} [r_{w,t+1}] = \alpha^{2} + c^{2} \sum_{k=1}^{3} \omega_{k} (e_{t-k} \delta^{0} e_{t-k})
\]

I use Maximum Likelihood to get the estimators for \( \{ \delta^{0}, \alpha, c \} \).
The second stage

I then bring the estimated results, \( \{ \hat{\lambda}, \hat{\alpha}, \hat{\varepsilon} \} \), to the second stage. This stage is to estimate the parameters of the country returns part. The model is as follows:

\[
\begin{align*}
    r_{reg,t} &= \phi_{reg,t-1} \lambda_{t-1} Cov_{t-1}[r_{reg,t}, r_{w,t}] + (1 - \phi_{reg,t-1}) \lambda_{reg,t-1} Var_{t-1}[r_{reg,t}] + \varepsilon_{reg,t} \\
    r_{w,t} &= \lambda_{t-1} Var_{t-1}[r_{w,t}] + \varepsilon_{w,t} \\
    R_{reg,t} &= [r_{reg,t}, r_{w,t}]’ \\
    e_{reg,t} &= [e_{reg,t}, \varepsilon_{w,t}]’ \\
    e_t &= \phi_{reg,t-1} e_t^l + (1 - \phi_{reg,t-1}) e_t^S
\end{align*}
\]

where the regional price of risk, \( \lambda_{reg,t-1} \), the conditional variance under market integration, \( \sum^l_t \), the conditional variance under market segmentation, \( \sum^S_t \), and the regional market integration degree, \( \phi_{reg,t-1} \), are given by:

\[
\begin{align*}
    \lambda_{reg,t-1} &= d(\delta_{reg} Z_{reg}^{t-1}) \\
    \sum^l_{reg,t} &= C_{reg}^l + (A_{reg}^l) 0 \left[ \sum^3_{k=1} \left( e_t - \phi_{reg,t-2} f_{1,t-2} \right) \right] A_{reg}^l \\
    \sum^S_{reg,t} &= C_{reg}^S + (A_{reg}^S) 0 \left[ \sum^3_{k=1} \left( e_t - \phi_{reg,t-2} f_{1,t-2} \right) \right] A_{reg}^S \\
    \phi_{reg,t-1} &= (1 - Q_{reg,t-1}^l) + (P_{reg,t-1}^l + Q_{reg,t-1}^l - 1) \frac{f_{1,t-1} \phi_{reg,t-2}}{f_{1,t-1} \phi_{reg,t-2} + f_{2,t-1} (1 - \phi_{reg,t-2})}
\end{align*}
\]

Then I am going to use ML to get the estimators for \( \{ \lambda_{reg}, \phi_{reg}, C_{reg}^l, C_{reg}^S, A_{reg}^l, A_{reg}^S \} \).

The third stage
I then bring the estimated results, \( \hat{\lambda}_{reg}, \hat{\phi}_{reg}, \hat{C}_{reg}, \hat{C}_s, \hat{A}_{reg}, \hat{A}_s \), to the third stage. This stage is to estimate the parameters of the country returns part. The model is as follows:

\[
\begin{align*}
    r_{i,t} &= \phi_{i,t-1} \left( \hat{\phi}_{reg,t-1} \hat{\lambda}_{t-1} \text{Cov}_{t-1}[r_{i,t}, r_{w,t}] ight) \\
        &+ \left( 1 - \phi_{reg,t-1} \right) \hat{\lambda}_{reg,t-1} \{ \text{Cov}_{t-1}[r_{i,t}, r_{reg,t}] - p_1 \text{Cov}_{t-1}[r_{i,t}, r_{w,t}] \} \\
        &+ (1 - \phi_{i,t-1}) \lambda_{i,t-1} \text{Var}_{t-1}[r_{i,t}] + \varepsilon_{i,t} \\

    r_{reg,t} &= \hat{\phi}_{reg,t-1} \hat{\lambda}_{t-1} \text{Cov}_{t-1}[r_{reg,t}, r_{w,t}] + (1 - \phi_{reg,t-1}) \lambda_{reg,t-1} \text{Var}_{t-1}[r_{reg,t}] + \varepsilon_{reg,t} \\

    r_{w,t} &= \hat{\lambda}_{t-1} \text{Var}_{t-1}[r_{w,t}] + \varepsilon_{w,t} \\

    R_{i,t} &= [r_{i,t}, r_{reg,t}, r_{w,t}'] \\

    e_{i,t} &= [e_{i,t}, \varepsilon_{reg,t}, \varepsilon_{w,t}] \\

    e_t &= \phi_{1,t-1} e_{1,t} + (1 - \phi_{i,t-1}) e_{S,t} \\
\end{align*}
\]

where the country price of risk, \( \lambda_{i,t-1} \), the conditional variance under market integration, \( \sum^l_i \), the conditional variance under market segmentation, \( \sum^S_i \), and the market integration degree, \( \phi_{i,t-1} \), are given by:

\[
\begin{align*}
    \lambda_{i,t-1} &= d(\delta^l_i Z^l_{t-1}) \\
    \sum^l_{i,t} &= C^l_i + (A^l_i)^0 \left[ \sum_{k=1}^{3} \omega_k \left( e_{i-k} e_{t-k}^0 \right) \right] A^l_i \\
    \sum^S_{i,t} &= C^S_i + (A^S_i)^0 \left[ \sum_{k=1}^{3} \omega_k \left( e_{i-k} e_{t-k}^0 \right) \right] A^S_i \\
    \phi_{i,t-1} &= (1 - Q_{t-1}) + (P_{t-1} + Q_{t-1} - 1) \frac{f_{1,t-1} \phi_{i,t-2}}{f_{1,t-1} \phi_{i,t-2} + f_{2,t-1}(1 - \phi_{i,t-2})}
\end{align*}
\]
Likewise, I use ML to estimate \( \{ \lambda_i, \phi_i, C_i^1, C_i^5, A_i^1, A_i^5 \} \).

### The fourth stage

Next, I bring the estimated results from the third stage to estimate the rest of parameters in this stage. This stage is to estimate the parameters of the specific portfolio return part.

The model is as follows:

\[
\begin{align*}
    r_{i,t}^A & = \hat{\phi}_{i,t-1} + \left(1 - \hat{\phi}_{i,t-1}\right) \lambda_{i,t-1} Cov_{t-1} \left[ r_{i,t}^A, r_{w,t} \right] \\
    & \quad \left( + (1 - \hat{\phi}_{i,t-1}) \lambda_{i,t-1} Cov_{t-1} \left[ r_{i,t}^A, \tilde{r}_{reg} \right] - p_1 Cov_{t-1} \left[ r_{i,t}^A, r_{w,t} \right] \right) \\
    r_{i,t} & = \hat{\phi}_{i,t-1} + \left(1 - \hat{\phi}_{i,t-1}\right) \lambda_{i,t-1} Cov_{t-1} \left[ \tilde{r}_{i,t}, \tilde{r}_{w,t} \right] \\
    & \quad \left( + (1 - \hat{\phi}_{i,t-1}) \lambda_{i,t-1} Cov_{t-1} \left[ \tilde{r}_{i,t}, \tilde{r}_{reg} \right] - p_1 Cov_{t-1} \left[ \tilde{r}_{i,t}, \tilde{r}_{w,t} \right] \right) \\
    r_{reg,t} & = \hat{\lambda}_{t-1} Cov_{t-1} \left[ \tilde{r}_{reg}, \tilde{r}_{w,t} \right] + (1 - \hat{\lambda}_{t-1}) \lambda_{reg,t-1} Cov_{t-1} \left[ \tilde{r}_{reg}, \tilde{r}_{w,t} \right] + \tilde{\epsilon}_{reg,t} \\
    r_{w,t} & = \hat{\lambda}_{t-1} Cov_{t-1} \left[ \tilde{r}_{w,t}, \tilde{r}_{w,t} \right] + \tilde{\epsilon}_{w,t} \\
    R_{i,t} & = \left[ \tilde{r}_{i,t}^A, \tilde{r}_{w,t} \right] \\
    e_{i,t} & = \left[ \tilde{\epsilon}_{i,t}^A, \tilde{\epsilon}_{i,t}, \tilde{\epsilon}_{i,t}^b, \tilde{\epsilon}_{i,t}^h, \tilde{\epsilon}_{i,t}^l, \tilde{\epsilon}_{i,t}^r, \tilde{\epsilon}_{i,t}^e, \tilde{\epsilon}_{i,t} \right]
\end{align*}
\]

where the price of size risk and the price of value risk, \( \lambda_{i,t-1}^5 \) and \( \lambda_{i,t-1}^V \), the conditional variance under market integration, \( \sum_t^l \), and the conditional variance under market segmentation, \( \sum_t^S \), are given by:
$$\lambda_{i,t-1}^p = d(\delta_i^0 Z_{t-1}^i) \quad p = s,v$$

$$\sum_{i,t}^I = C^I + (A^I)^0 \left[ \sum_{k=1}^3 \omega_k (e_{t-k} e_{t-k}^0) \right] A^I$$

$$\sum_{i,t}^S = C^S + (A^S)^0 \left[ \sum_{k=1}^3 \omega_k (e_{t-k} e_{t-k}^0) \right] A^S$$

And then I use ML to estimate \( \{ \lambda^p, C^I, C^S, A^I, A^S \} \).
Table I. CAPM Results

CAPM model:  \( R_{j,t} - R_f = C(1)_j + C(2)_j (R_{m,t} - R_f) + \varepsilon_{j,t} \)

(*** is 1%, ** 5% and *10% statistically significant)

<table>
<thead>
<tr>
<th>Country</th>
<th>Small Portfolio</th>
<th>Large Portfolio</th>
<th>Glamour Portfolio</th>
<th>Value Portfolio</th>
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<td>C(2)</td>
<td>C(1)</td>
<td>C(2)</td>
</tr>
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<td>-0.85**</td>
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<td>0.99***</td>
</tr>
<tr>
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<td>-1.35*</td>
<td>0.91***</td>
<td>-1.4***</td>
<td>0.99***</td>
</tr>
<tr>
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<td>-1.74*</td>
<td>1.16***</td>
<td>-0.92***</td>
<td>0.97***</td>
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</tbody>
</table>
Table II. Fama and French’s Three Factor Model Results

Three Factor Model: \( R_j - R_f = C(1)_j + C(2)_j (R_m - R_f) + C(3)_j SMB + C(4)_j HML + \epsilon \)

<table>
<thead>
<tr>
<th>Country</th>
<th>Small Size Portfolio</th>
<th>Large Size Portfolio</th>
<th>Glamour Portfolio</th>
<th>Value Portfolio</th>
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<td>C(3)</td>
<td>C(4)</td>
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<td>0.55***</td>
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<td>0.55***</td>
<td>0.66***</td>
<td>0.47***</td>
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<td>-0.12***</td>
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<td>0.99***</td>
<td>0.89***</td>
<td>-0.04***</td>
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</tbody>
</table>

(* indicates 1% significance, ** 5% and *10% statistically significant)
Table III. Possible Break Dates
The data source is from Bekaert and Harvey (2000), Foreign Speculators and Emerging Equity Markets. They summarized the choices for official liberalization dates of emerging countries in Appendix B.

<table>
<thead>
<tr>
<th>Liberalization</th>
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<th>Malaysia</th>
<th>Pakistan</th>
<th>Philippines</th>
<th>Taiwan</th>
<th>Thailand</th>
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Table IV: The Partition Test of Fama and French’s Three Factor Model

Small Portfolio

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<th>C(3)</th>
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<td>P 2</td>
<td>P 3</td>
<td>P 1</td>
</tr>
<tr>
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<td>X</td>
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<td>-0.7***</td>
<td>--------</td>
<td>0.44***</td>
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<td>-0.4</td>
<td>-0.003</td>
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<td>X</td>
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<td>-1.45***</td>
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<td>0.44***</td>
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<td>-0.44</td>
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(*** is 1%, ** 5% and *10% statistically significant)
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<th>C(3)</th>
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<td>-0.71***</td>
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<td>0.9***</td>
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<td>0.64***</td>
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### Value Portfolio

(* * * is 1%, ** 5% and *10% statistically significant)

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<td>-0.57</td>
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<td>0.98***</td>
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## Glamour Portfolio

(*** is 1%, ** 5% and *10% statistically significant)

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<th>C(3)</th>
<th>C(4)</th>
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<td>P 3</td>
<td>P 1</td>
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<td>-0.5</td>
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<td>-1.36**</td>
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<td>X</td>
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<td>-1.26***</td>
<td>-0.94***</td>
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<td>-0.21</td>
<td>0.8***</td>
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</table>
Table V: The Estimated Results of the First Stage

\[ r_{w,t} = \lambda_{t-1} Var_{r,w} [r_{w,t}] + \varepsilon_{w,t} \]
\[ \lambda_{t-1} = d(\delta Z_{t-1}) \]
\[ Var_{r,w} [r_{w,t}] = \alpha^2 + c^2 \sum_{k=1}^{\delta} \omega_k (e_{t-k} e'_{t-k}) \]

Z includes a constant, the Asian market dividend yield, the default spread (Moody's Baa minus Aaa bond yields), the change in the term structure spread (U.S. 10-year bond yield minus 3-month U.S. bill), and the change in the 30-day Eurodollar rate.

<table>
<thead>
<tr>
<th>( \delta_1 )</th>
<th>( \delta_2 )</th>
<th>( \delta_3 )</th>
<th>( \delta_4 )</th>
<th>( \delta_5 )</th>
<th>( \alpha )</th>
<th>( c )</th>
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<tbody>
<tr>
<td>-23.20</td>
<td>798.12</td>
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<td>-111.73</td>
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<td>-0.1663</td>
</tr>
<tr>
<td>(19.22)</td>
<td>(718.12)</td>
<td>(620.9)</td>
<td>(151.70)</td>
<td>(106.83)</td>
<td>(0.0071)</td>
<td>(1.1063)</td>
</tr>
</tbody>
</table>

Table VI: The Average Market Integration Degree in Each Partition

<table>
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<tr>
<th>Country</th>
<th>Market Integration Full Sample</th>
<th>Market Integration Pre-liberalization</th>
<th>Market Integration Between Liberalization and Crisis</th>
<th>Market Integration Post-crisis</th>
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<tr>
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<td>0.6302</td>
<td>0.7251</td>
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<td>Korea</td>
<td>0.9269</td>
<td>0.8921</td>
<td>0.9509</td>
<td>0.9393</td>
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<tr>
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<td>0.5945</td>
<td>0.5106</td>
<td>0.6512</td>
<td>0.5416</td>
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<td>Pakistan</td>
<td>0.3789</td>
<td>0.1832</td>
<td>0.4560</td>
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<td>0.2821</td>
<td>0.3317</td>
<td>0.2268</td>
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<tr>
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<td>0.3740</td>
<td>0.0051</td>
<td>0.4053</td>
<td>0.4236</td>
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Table VII: Adjusted R-squared and Wald statistics for the Regression of the Residual of Return on a Set of Information Variables

Aggregate Country Returns

<table>
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<tr>
<th>Country</th>
<th>International information ${Z, Z_{reg}}$</th>
<th>Local information $Z_i$</th>
<th>Total—International plus Local</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted R-squared</td>
<td>Wald statistics</td>
<td>Adjusted R-squared</td>
</tr>
<tr>
<td>India</td>
<td>-0.0059</td>
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<td></td>
<td>[0.07]</td>
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<td>[0.0504]</td>
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<td>[0.0000]</td>
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<td>[0.0000]</td>
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<td>[0.0000]</td>
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<td>0.8404</td>
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## Small Size Portfolio

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<th>Local information Zi</th>
<th>Total—International plus Local</th>
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<td>Adjusted R - squared</td>
<td>Wald statistics</td>
<td>Adjusted R - squared</td>
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<td>0.0072</td>
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## Large Size Portfolio

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<tr>
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<th>Local information $Z_i$</th>
<th>Total—International plus Local</th>
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</thead>
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<td>Wald statistics</td>
<td>Adjusted R-squared</td>
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<td>-0.0067</td>
<td>7.6927 [0.1740]</td>
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<td>Korea</td>
<td>0.0549</td>
<td>17.9502 [0.0030]</td>
<td>0.1111</td>
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<td>0.0007</td>
<td>4.6147 [0.4647]</td>
<td>0.8841</td>
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<td>-0.0198</td>
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<td>Wald statistics</td>
<td>Adjusted R - squared</td>
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<td>Local information $Z_i$</td>
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<tr>
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Figure I: The Movement of the World Price of Risk
Figure II: The Market Integration of the Pacific Asian Region
Figure III: The Market Integration Degree for Each Country
Figure IV: The Fitted Country Price of Risk
Figure V: The Fitted Price of Size Risk
Figure VI: The Fitted Price of Value Risk